ASTR 1001.2

Assignment 4.

1. If the quasar phenomenon can only occur in very young galaxies, say $< 10^9$ years old, then, since redshift is proportional to age in the universe, galaxies being presumed to have been created soon after the Big Bang, we would expect to see quasars only at very large redshifts, typically $z \approx 4$ (for distance/13.6×10^9 yrs $= 0.926$). In other words, according to such a hypothesis, quasars would only be seen in galaxies of very large redshift, so their numbers should peak at $z \approx 4$ with few to none nearby at $z < 1$.

2. If extragalactic globular clusters exist as galaxies, then they fall in the elliptical galaxy class since they are of circular shape containing only old stars and no gas or dust. Specifically, because of their small dimensions relative to standard elliptical galaxies, they would likely be classified as dwarf spheroidal galaxies, dSph, or even mistakenly as E0 or dE.

3. The zone of avoidance represents the band of sky coincident with the main plane of the Milky Way, where all of the interstellar dust is located. Since dust obscures the light from stars in other galaxies, it blocks their light making them difficult, or impossible, to see, even in the infrared. Such an observation implies that our Galaxy must contain copious quantities of interstellar dust — lots of dust!

4. According to the Hubble scheme, our Galaxy would be classified as Sb. It is a spiral galaxy without a dominant central bar, and has a sizable bulge, larger than the puny bulges in Sc galaxies but smaller than the dominant bulges in Sa galaxies — i.e. halfway in between, or Sb. The large amounts of interstellar dust rule out an alternate classification as a lenticular, say S0b.

5. Since the LMC and M31 (Andromeda galaxy) are part of the Local Group and do not partake of the Hubble flow, they cannot be used to evaluate the Hubble constant H_0. They are too close and their observed radial velocities reflect mostly the Sun's orbital motion about the Galactic centre.

6. The evidence for a supermassive "black hole" at the centre of the Milky Way consists mainly of the very rapid motions of stars about Sgr A* detected in the infrared. Since the distance to the Galactic centre is known reasonably well (~8 kpc), the periods and observed semi-major axes for the orbiting stars can be used to derive a mass for Sgr A*, yielding a value ≥ 4 million $M_\odot$. Since the observed size of 37 milliarcseconds corresponds to a diameter of ~ 0.0015 parsec, it implies an extremely large density for Sgr A* inconsistent with the densities of ordinary matter or extreme stars such as neutron stars. The only option is to consider Sgr A* to be a black hole.